CESPL-RG-A 23 May 2008

MEMORANDUM FOR THE RECORD

SUBJECT: Determination of Two Reaches of the Santa Cruz River as Traditional Navigable Waters (TNW)

Summary

The Corps' Los Angeles District has determined that two reaches of the Santa Cruz River, Study Reach A from Tubac gage station (USGS # 09481740) to the Continental gage station (USGS #09482000) and Study Reach B from Roger Road wastewater treatment plant (WWTP) downstream to the Pima/Pinal County line, Arizona, as shown in Exhibit A, are TNWs (collectively, referred to as the "Study Reaches"). This determination is consistent with the Clean Water Act (CWA), the agencies' regulations (including 33 C.F.R.§ 328.3), relevant case law, and existing guidance, including the June 5, 2007 joint U.S. Environmental Protection Agency and Department of the Army legal memorandum entitled *Clean Water Act Jurisdiction Following the U.S. Supreme Court's Decision in Rapanos v. United States & Carabell v. United States* (Rapanos Guidance) and *Appendix D* of the *U.S. Army Corps of Engineers Jurisdictional Determination Form Instructional Guidebook* issued June 5, 2007 (Appendix D).

Background

The Santa Cruz River originates in Arizona, flows south into Mexico, and then flows north again into Arizona. It is the primary river which flows from Nogales, Mexico through Tucson, Arizona, and a number of Indian reservations, including Tohono O'odham Nation (TON), to the Gila River near Phoenix. The watershed of the Santa Cruz River is approximately 8,600 square miles. Until the late nineteenth century, the Santa Cruz River was primarily a perennial watercourse that served the region's agricultural needs until a quickly developing industrial society began to tap the river's subsurface flow (Exhibit B).

The Upper Santa Cruz River Valley, located between Nogales, Arizona on the US-Mexico border, and extending 65 miles north to the major urban area of Tucson, has a long history of European settlement spanning three centuries. Prior to the discovery of the area by European explorers, the area was inhabited for thousands of years by aboriginal native peoples. The Santa Cruz River has long been an important corridor for trade and exploration. The river and its well-established riparian habitat have served as a vital commodity for people and wildlife in the region.[1]

In addition to the use of the Study Reaches by recreational watercraft described in case-specific analysis below, in the mid 1850s, William Rowlett and his brother, Alfred, constructed an earthen dam on the Santa Cruz River south of the present-day Silverlake Road. They also installed a water-powered flour mill at this location in 1857/58. In 1860, William Grant purchased the flour mill and the dam/lake and improved the dam and mill in order to supply military posts in the southwestern region. He built a second, larger mill on the river and purchased the machinery in California. However, the mill was burned in 1861 to keep it from falling into Confederate hands. The mill was purchased by James Lee and returned to operations in 1864. In 1884, the mill, dam,

[1] *The Santa Cruz River: A Resource Shared by Two Cities* by Hugh Holub, paper presented to the Border XXI EPA Regional Water Sub Work Group Meeting on March 6, 2001, Nogales, Sonora.

and lake were sold to Frederick Maish and Thomas Driscoll who developed the Silver Lake Resort. In 1883, Solomon Warner built a second dam and mill on the river. The lake was approximately 60 acres, 8 feet deep, and the *Arizona Citizen* reported the use of a flat-bottom boat on the lake. Waterfowl populated the lake and hunting organizations claimed exclusive rights to shooting the waterfowl. The dams at both Silver Lake and Warner's Lake were breached by floods in 1886 and 1887; the *Arizona Star* reported on July 13, 1887 that the river was wide and deep enough to float a "mammoth steamboat." In 1888, Frank and Warren Allison purchased Warner Lake, repaired the dam, and stocked the lake with carp for commercial fish production selling over 500 pounds of fish per day. Both dams were washed out by 1890.[2]

Further, in the summer of 1951, Glenton G. Syke, Tucson city engineer, navigated the Santa Cruz River in a 14-foot-long boat from the San Xavier del Bac Mission to Congress Street in Tucson.[3]

The Study Reaches were selected based on personal knowledge of the river by Regulatory staff, evidence of perennial flows based on stream gage data, and more readily available evidence of navigability.

Basis for TNW Determination

The Rapanos Guidance indicates that in its context, the term TNW refers to those waters that are under the jurisdiction of the Corps, pursuant to 33 C.F.R. § 328.3(a)(1), (i.e., "[a]ll waters which are currently used, or were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide."

As stated in Appendix D: "when determining whether a water body qualifies as a "traditional navigable water" (i.e., an (a)(1) water), relevant considerations include whether a Corps District has determined that the water body is a navigable water of the United States pursuant to 33 C.F.R. § 320.14, or the water body qualifies as a navigable water of the United States under any of the tests set forth in 33 C.F.R. Part 329, or a federal court has determined that the water body is navigable-in-fact under federal law for any purpose, or the water body is "navigable-in-fact" under the standards that have been used by the federal courts."

To determine whether the Study Reaches are a TNW, in accordance to 33 C.F.R. § 328.3(a)(1), a case-specific analysis to evaluate whether the Study Reaches are navigable-in-fact, including consideration of its potential susceptibility to interstate and foreign commerce, was undertaken. The Corps has determined that the Study Reaches are a TNW based on the following factors:

1. The physical characteristics of the Santa Cruz River within the Study Reaches indicate that they have the capacity and susceptibility to be navigated by recreational watercraft.

A. Study Reach A is approximately 22 miles in length. The river near Tubac is typically more confined in ordinary flows to a channel approximately 15-20 feet wide with an approximate 1.5 mile wide, densely vegetated floodplain. Downstream of Amado, the floodplain increases in width to approximately 2.5 miles; the river channel is less confined, less vegetated, and more braided. Exhibit C shows monthly and daily flows for the Tubac, Amado, and Continental gage stations, as well as peak flows for the Amado and Continental gage stations (Tubac information unavailable). The monthly gage data indicate perennial flow at Tubac since

[2] History of Navigation of the Santa Cruz River by Don Bufkin, citation unknown.
[3] Admiral of the Santa Cruz by Glenton G. Sykes, The Journal of Arizona History, Vol. 20, Number 4, Winter, 1979.

1996, flow most months at the Amado gage station since 2003 (prior years unavailable), and intermittent flows at the Contintental gage station.[4] Average daily flows are typically lower in May and June but increase during the summer monsoon season which typically begins in July. Average daily flow rates again typically increase during December and January. The gage data indicate the highest daily mean value at the Tubac gage station over the last 11-12 years was 637 cubic feet per second (cfs) during October and the lowest daily mean value at the same station during the same period was 4.5 cfs during June. The highest daily mean values typically occur from July-October.[5] The range of mean monthly flows (6.9 to 78 cfs) and the average daily flow in a representative year of 35 cfs indicate perennial flow at the Tubac gage station. The mean monthly discharge information at the Amado gage station is only available since October, 2003; the mean monthly discharge at this station in the last four years varied from .97 cfs to 67 cfs while the daily mean flow chart at the Amado gage station indicates perennial flow. The mean monthly discharge at the Continental gage station since 1940 varies from .43 cfs to 76 cfs while the mean daily values since 1939 shows flow daily with the exception of mid to late May through mid-June. This is expected since the river begins subsurface flow at this point, which defines the downstream end of this Study Reach.

B. Study Reach B is approximately 32 miles in length. The width of the riverbed varies from approximately 280 feet at the Roger Road WWTP to approximately 670 feet at Cortaro and approximately 575 feet at Trico Road while the active (ordinary flow) river channel at all three locations varies from 40-60 feet; at one location within this Study Reach, the river diverges into two similarly-sized channels. The river in Study Reach B is often confined at its maximum width by steep banks with soil cement or other bank stabilization in several locations. In other locations, for example at Ina Road, the river has lower, easily accessible, vegetated banks. Some areas are more densely vegetated than others. Exhibit C shows monthly, daily, and peak flows for gage stations at Cortaro and Trico Road (just upstream of the Pima/Pinal County line). Average daily flows are typically lower in May and June but increase during the summer monsoon season which typically begins in July. Average daily flows again typically increase during December and January. The highest average daily mean value at the Cortaro gage station over the last 57-60 years was 703 cfs, also in October, and the lowest average daily mean value at the same station over the same period was 22 cfs during June. The average monthly discharge ranges from 23 to 124 cfs and the average daily flow in a representative year of 75 cfs indicate perennial flow at the Cortaro gage station. At the Trico Road gage station, since 1997, the average monthly discharge ranged from 3.5 cfs to 710 cfs and daily mean values since 1989 ranged from 11 cfs to 863 cfs. The gage data document perennial flow at the Cortaro and Trico Road gages every month since 1996 with the exception of October, 1996.[6]

C. The peak flow charts demonstrate the frequency of flows which exceed 1,000 cfs.[7] Peak flow data is unavailable at the Tubac gage station; however, the maximum peak flow at the Amado gage station since 2004 was approximately 7,800 cfs and peak flow has approached or exceeded 2,000 cfs annually. The maximum peak flow at the Continental gage station was approximately 45,000 cfs in the early 1980s and the minimum peak flow has exceeded 1,000 cfs 63 times since 1940. The maximum peak flow at the Cortaro gage station exceeded 60,000 cfs in the early 1980s and has exceeded 1,000 cfs on an annual basis from 1940-1988 with the exception of once in the 1940s and once in the 1950s; the peak flow at the Cortaro gage station

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[4] http://nwis.waterdata.usgs.gov/az/nwis/monthly
[5] http://nwis.waterdata.usgs.gov/az/nwis/dvstat
[6] Ibid
[7] http://nwis.waterdata.usgs.gov/az/nwis/peak

has also exceeded 1,000 cfs on an annual basis since approximately 1995. The maximum peak flow at the Trico gage station exceeded 25,000 cfs in 2007 and the minimum peak flow has been at or exceeded 1,000 cfs most years since 1989. The figures at the end of Exhibit C indicate the "real time" stages for late March-early April, 2008, at the Tubac, Cortaro, and Trico Road gage stations indicating flows in the river on a daily basis.[8] All three stations indicated flows with depths varying from 1-2 feet and no precipitation had occurred for approximately 6 weeks.[9] Additional real-time stage data obtained for late May is also provided for Tubac, Green Valley (near Continental), Cortaro, and Trico Road and indicates 1-2 feet of water currently in the channel at all the above locations. Extremely light precipitation occurred one day during this timeframe; however, the amount of precipitation received would not have been sufficient to cause surface flows[10]. A list of the large magnitude peak flow events of the Santa Cruz River over the last 100 years is provided at Exhibit D.[11]

D. While there is a variation in minimum flow required for canoeing, studies indicate the 95% confidence interval on the predicted minimum canoeing flow of 86 cfs for flatwater is 63 to 118 cfs.[12] Approximately two-three feet of water depth is sufficient to float a canoe, kayak, or small boat. Based on the above information, during most days from July-October and again for approximately half the months of December and January, there is sufficient flow in the Santa Cruz River within the Study Reaches to float a canoe (based on the average daily mean value). Typically a kayak would be able to navigate in lower flows and less water than canoes.

E. Based on aerial photographs attached at Exhibit E, the Santa Cruz River from Tubac gage station to just upstream of Continental gage station and Roger Road WWTP to the Pima/Pinal County line has uninterrupted flow.

F. The Arizona Department of Environmental Quality has adopted water quality standards for the Santa Cruz River for partial body contact.[13] Partial body contact allows for use of the surface water where the body comes into contact with the water but does not become fully submerged. Allowable uses under partial body contact would include but are not limited to boating and wading.

2. The Study Reaches within the Santa Cruz River have public accessibility.

A. The river has low banks in the vicinity of Tubac which allows for easy public access; these areas are currently frequented by riders on horseback. Resorts along the river provide access for out-of-state visitors for birding and hiking along the river.

B. Two Corps of Engineers feasibility studies for river restoration, El Rio Medio and Tres Rios del Norte, are in process. El Rio Medio will begin at Congress Street and progress downstream to Prince Road; Tres Rios del Norte will begin at Prince Road and progress

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[8] National Weather Service Advanced Hydrologic Prediction Service: http://www/nws.noaa.gov/oh/ahps/
[9] Personal observation, Marjorie Blaine, Senior Project Manager, Regulatory Division, Tucson Project Office
[10] Ibid
[11] http://www.wrh.noaa.gov/twc/hydro/floodhis.php
[12] Riparian Areas of the Southwestern United States: Hydrology, Ecology, and Management by Malchus B. Baker and Peter F. Ffolliott, CRC Press, 2004
[13] Personal communication with Steve Pawlowski, Arizona Department of Environmental Quality, Unit Manager, Water Quality Standards and Assessments, April 24, 2008.

downstream to Sanders Road in Marana. These projects will provide public trails along the river. Although the final design for these two projects has not been completed, it is likely river access will be provided. The two projects are shown in Exhibit F.

C. There is currently public access to the river at several bridges, including but not limited to the Ina Road bridge where there are pull-out areas, the Cortaro Road bridge (including a parking lot), and at the Sanders Road bridge in Marana. All of these bridges have easy access to Interstate 10.

D. The historic 1200-mile Juan Bautista de Anza National Historic Trail runs from Nogales, Arizona to San Francisco, California. This trail parallels and overlaps the Santa Cruz River in the Study Reaches. The river can be accessed at several points along this trail in the Study Reaches by auto or also on foot (Exhibit F).

3. The Study Reaches of the Santa Cruz River have been used for interstate commerce and have the potential to be used for commercial activities involving navigation and interstate commerce in the future.

A. Navigation has occurred historically and recent times within the Study Reaches of the Santa Cruz River.

(1) On August 23, 2005, as part of a promotion, a local radio show host navigated the Santa Cruz River in a raft for an unspecified distance starting at El Camino del Cerro (within Study Reach B) (Exhibit G).

(2) In October, 1994, two members of the Friends of the Santa Cruz navigated a 17-foot-long canoe from a point south of Tubac three miles to a point north of Tubac (Exhibit G).

B. The Santa Cruz River is an international and interstate water. Several areas along the river provide access for birding by out-of-state visitors and resorts bordering the river, such as the Tubac Golf Resort, host out-of-state visitors who partake in local recreation including hiking, horseback riding, and birding along the river. The Tucson Audubon Society's North Simpson Farm is an area where prolific riparian habitat restoration projects have been focused and it is well-known for its opportunities for birding. This type of "ecotourism" provides a significant water resource-oriented opportunity in the desert. The Study Reaches and other areas within the region receive many interstate and foreign tourists seeking to expand their "bird list"; the Sonoran Desert, particularly in riparian areas such as the Santa Cruz River, provides a significant opportunity to see species endemic to this area.

C. Use of the river within the Study Reaches by recreational watercraft provides evidence of the susceptibility for commercial use.

Determination

Public access points within of the Study Reaches such as low river banks, bridges, and trail systems, together with their physical characteristics, such as frequency, duration, and permanency of flow, indicate that the Study Reaches have the potential to be used for commercial recreational navigation activities, such as canoeing, kayaking, birding, nature and wildlife viewing. Such attractions and activities demonstrate that the Study Reaches may be susceptible to use in interstate commerce. Collectively, the above discussed factors demonstrate that the Study

Reaches are navigable-in-fact, and thus a TNW, susceptible to use in interstate commerce associated with recreational navigation activities. Therefore, I hereby determine that the Study Reaches are subject to the jurisdiction of Section 404 of the CWA, pursuant to 33 C.F.R. § 328.3(a)(1).

This determination does not 1) consider any other potentially applicable bases for determining CWA jurisdiction within the Study Reaches or 2) foreclose analysis of other areas of the Santa Cruz River outside the Study Reaches for purposes of determining CWA jurisdiction.

5/23/08
Date

Thomas H. Magness
Colonel, US Army
District Commander

EXHIBIT A

Study Reaches A and B

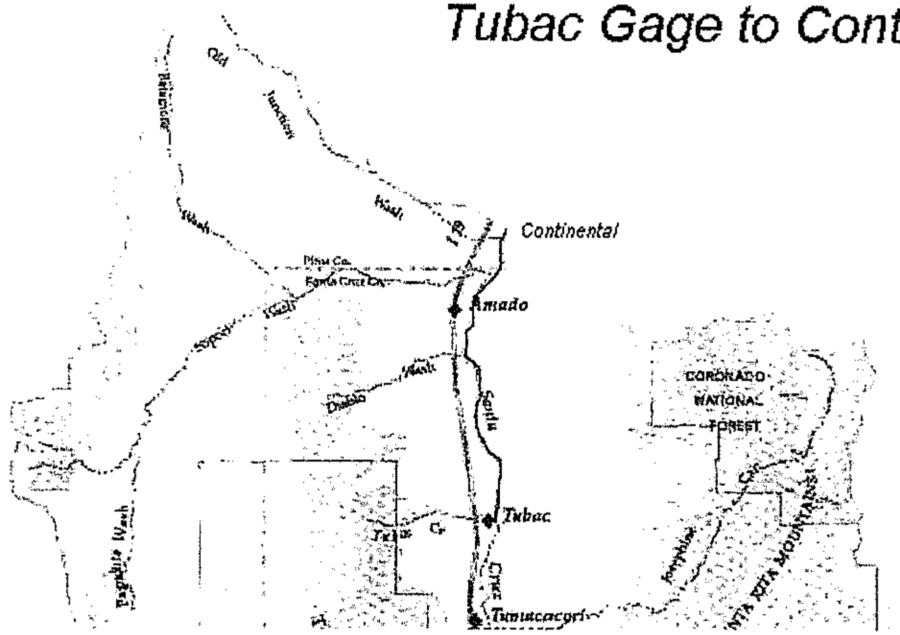
Maps Source: Arizona Department of Water Resources
Santa Cruz Active Management Area, Third Management Plan
Tucson Active Management Area, Third Management Plan

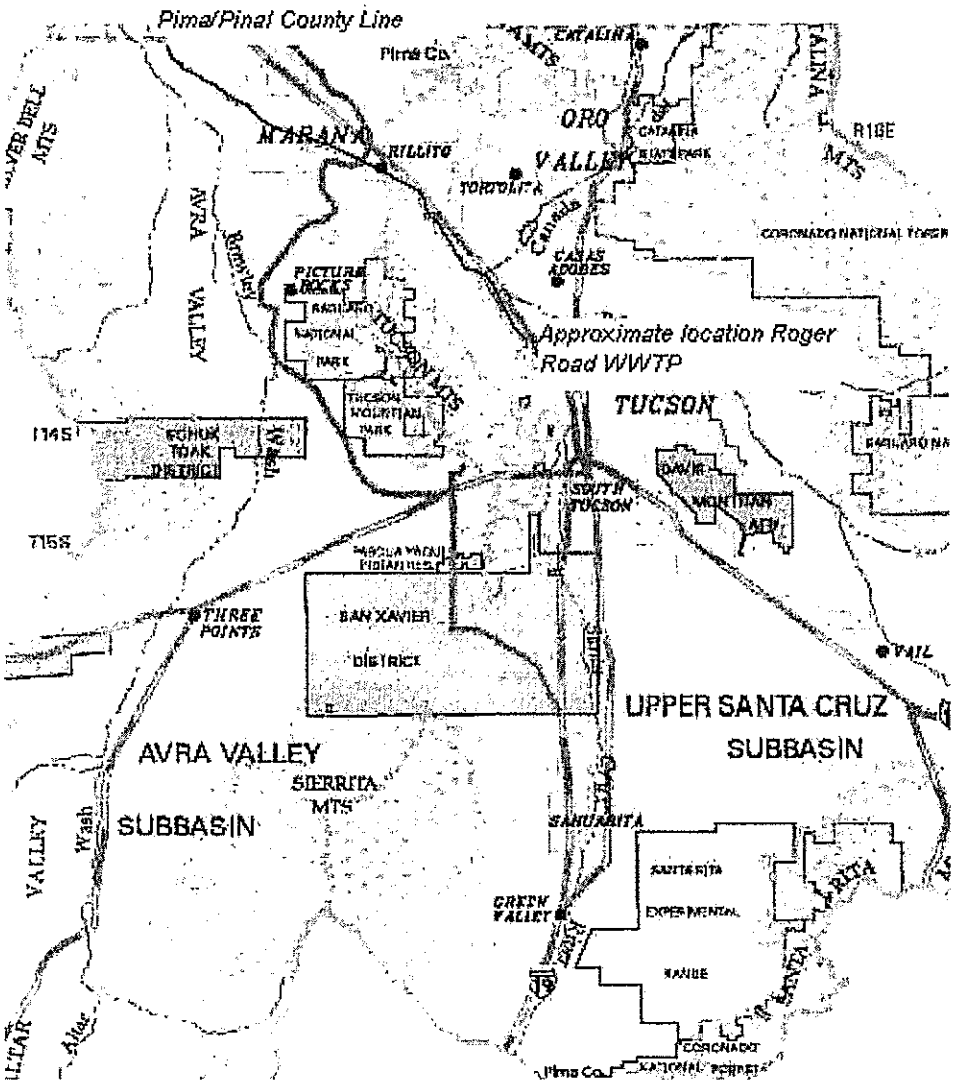
Purple denotes TNW segments

Study Reach A: Tubac Gage Station downstream to Continental Gage Station

Study Reach B: Roger Road WWTP downstream to Pima/Pinal County line

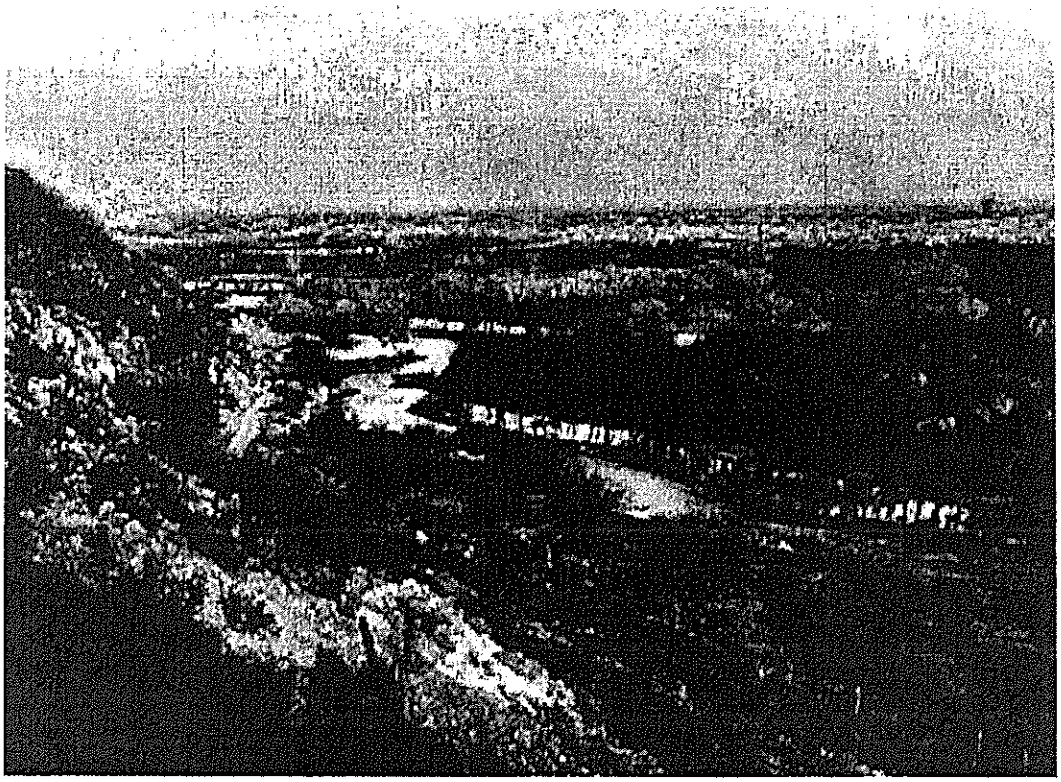
Santa Cruz River
Study Reach A
Tubac Gage to Continental Gage





Santa Cruz River -- Study Reach B Roger Road WWTP to Pima/Pinal County Line

EXHIBIT B
HISTORICAL PHOTO



Santa Cruz River in 1904

EXHIBIT C
FLOW DATA

Monthly, Daily, and Peak flow data retrieved April 1, 2008 from:
http://nwis.waterdata.usgs.gov/az/nwis/monthly

http://nwis.waterdata.usgs.gov/az/nwis/dvstat

http://nwis.wateradata.usgs.gov/az/nwis/peak

Hydrographs retrieved March 28, 2008 and May 23, 2008 from:

http://www.nws.noaa.gov/oh/ahps/

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USGS 09481740 SANTA CRUZ RIVER AT TUBAC, AZ.

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Santa Cruz County, Arizona
Hydrologic Unit Code 15050301
Latitude 31°36'46", Longitude 111°02'27" NAD27
Gage datum 3,180 feet above sea level NGVD29

Output formats

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00060, Discharge, cubic feet per second,												
YEAR	Monthly mean in cfs (Calculation Period: 1995-10-01 -> 2007-09-30)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1995										11.6	25.5	24.3
1996	24.2	25.3	22.6	12.5	4.72	3.62	17.1	22.1	15.1	8.99	14.7	17.1
1997	24.3	27.9	16.9	8.73	3.17	0.947	2.24	32.8	30.5	15.1	8.57	23.8
1998	28.3	67.7	45.4	46.3	20.7	12.6	62.8	46.7	27.1	18.0	19.1	21.3
1999	23.8	23.5	19.7	14.2	7.55	3.78	48.2	58.9	69.1	28.0	28.0	18.9
2000	23.6	25.0	24.8	20.1	10.0	22.4	23.4	29.0	19.2	798.4	277.9	91.1
2001	77.5	51.6	42.6	68.7	29.2	6.55	17.5	32.6	13.3	18.3	17.6	

2002	25.9	27.6	22.9	15.4	3.15			39.3	14.3	2.89	14.6	16.1
2003	14.6	19.0	16.0	9.73	3.23	0.117	31.0	60.9	13.3	9.40	18.6	18.1
2004	23.2	19.9	14.6	25.5	6.82	7.68	37.2	30.0	9.93	9.61	13.0	17.7
2005	14.7	14.3	14.6	11.4	8.55	8.36	102.8	211.5	3.62	5.50	10.8	12.5
2006	11.8	11.0	12.1	8.19	5.33	3.26	124.1	35.2	52.8	9.55	14.4	16.7
2007	14.8	16.9	15.5	11.6	8.07	6.26	110.9	116.1	23.8			
Mean of monthly Discharge	26	27	22	21	9.2	6.9	52	60	24	78	39	25

** No Incomplete data have been used for statistical calculation

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USGS 09481770 SANTA CRUZ NR AMADO, AZ

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Pima County, Arizona
Hydrologic Unit Code 15050301
Latitude 31°44'41", Longitude 111°02'11" NAD83
Gage datum 3,040 feet above sea level NAVD88

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Reselect output format

00060, Discharge, cubic feet per second,												
YEAR	Monthly mean in cfs (Calculation Period: 2003-10-01 -> 2007-09-30)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2003										0.000	0.078	2.64
2004	5.25	7.97	6.64	4.21	0.532	0.000	16.2	19.1	8.77	3.87	6.58	13.1
2005	19.2	17.5	12.0	4.42	4.73	3.90	32.0	112.0	0.000	0.000	0.000	0.000
2006	0.000	0.000	0.000	0.071	0.001	0.024	70.6	46.4	31.7	0.000	0.028	1.74
2007	4.37	8.39	8.75	7.54	1.31	0.098	96.4	89.9	16.0			
Mean of monthly Discharge	7.2	8.5	6.8	4.1	1.6	1.0	54	67	14	0.97	1.7	4.4

** No Incomplete data have been used for statistical calculation

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USGS 09482000 SANTA CRUZ RIVER AT CONTINENTAL, AZ

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Pima County, Arizona
Hydrologic Unit Code 15050301
Latitude 31°52'17", Longitude 110°58'46" NAD27
Drainage area 1,682.00 square miles
Gage datum 2,819.82 feet above sea level NGVD29

Output formats

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- Tab-separated data
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00060, Discharge, cubic feet per second,												
YEAR	Monthly mean in cfs (Calculation Period: 1940-05-01 -> 2007-09-30)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1940					0.000	3.43	9.84	164.0	29.3	0.003	0.000	0.452
1941	2.67	0.393	0.000	0.000	0.000	0.000	16.0	11.0	2.17	0.065	0.000	0.000
1942	0.000	0.000	0.000	0.000	0.000	0.000	18.6	29.8	9.73	0.000	0.000	0.000
1943	0.000	0.000	0.000	0.000	0.000	4.17	31.0	126.1	3.93	0.000	0.000	0.000
1944	0.000	0.000	0.000	0.000	0.000	0.000	0.129	62.4	3.87	8.13	0.067	0.000
1945	0.000	0.000	0.000	0.000	0.000	0.000	67.8	179.5	15.3	14.0	0.000	0.000
1946	0.000	0.000	0.000	0.000	0.000	0.000	79.0	70.4	39.8			

1951										7.32	0.000	0.000
1952	0.000	0.000	0.000	0.000	0.000	0.000	9.02	26.7	10.4	0.000	0.000	0.000
1953	0.010	0.018	0.000	0.000	0.000	0.000	112.7	0.697	0.000	0.000	0.000	0.000
1954	0.000	0.000	7.20	0.000	0.000	2.43	226.6	341.6	37.7	0.129	0.000	0.000
1955	0.000	0.000	0.000	0.000	0.000	0.000	47.4	753.0	0.017	0.023	0.000	0.000
1956	0.000	0.000	0.000	0.000	0.000	0.000	16.4	0.000	0.000	0.000	0.000	0.000
1957	0.000	0.000	0.000	0.000	0.000	0.000	4.66	15.2	0.000	0.023	0.000	0.000
1958	0.000	0.000	0.000	0.000	0.000	0.000	48.0	164.0	20.1	0.000	0.000	0.000
1959	0.000	0.000	0.000	0.000	0.000	1.93	10.1	78.5	0.013	0.000	0.000	2.34
1960	190.7	0.000	0.000	0.000	0.000	0.000	6.87	22.9	10.4	19.5	0.000	0.000
1961	0.000	0.000	0.000	0.000	0.000	0.000	15.6	53.6	23.5	0.000	0.000	42.8
1962	52.4	0.000	0.000	0.000	0.000	0.000	0.810	0.616	4.84	0.000	0.000	0.000
1963	0.000	0.000	0.000	0.000	0.000	0.000	71.4	122.4	29.9	0.000	4.37	0.000
1964	0.000	0.000	0.003	0.003	0.000	0.000	17.0	188.3	284.9	0.000	0.000	0.000
1965	0.000	0.000	0.000	0.000	0.000	0.000	0.203	0.639	2.30	0.000	0.000	421.5
1966	18.2	206.5	0.000	0.000	0.000	0.000	43.5	362.7	14.9	1.00	0.000	0.000
1967	0.000	0.000	0.000	0.000	0.000	0.450	44.3	6.47	4.70	0.874	0.000	658.1
1968	0.732	2.61	18.0	0.000	0.000	0.000	3.22	0.645	0.000	0.000	0.000	0.000
1969	0.000	0.000	0.000	0.000	0.000	0.000	6.87	36.4	4.95	0.174	0.000	0.100
1970	0.042	0.304	0.000	0.000	0.000	0.000	10.0	22.5	27.8	0.126	0.000	0.000
1971	0.000	0.000	0.000	0.000	0.000	0.000	8.76	175.6	21.7	2.27	0.000	0.010
1972	0.000	0.000	0.000	0.000	0.000	0.040	24.5	3.03	1.99	5.74	0.000	0.000
1973	0.000	56.7	123.8	0.000	0.000	0.000	0.642	0.000	0.000	0.000	0.000	0.000
1974	0.000	0.000	0.000	0.000	0.000	0.000	26.9	34.2	12.7	0.000	0.000	0.000
1975	0.000	0.000	0.000	0.000	0.000	0.000	42.7	8.32	30.6	0.000	0.000	0.000
1976	0.806	0.000	0.000	0.123	0.000	0.037	166.7	5.45	9.02	0.448	0.000	0.039
1977	0.006	0.000	0.000	0.000	0.000	0.000	21.5	39.0	42.8	755.2	0.000	0.000
1978	6.23	70.9	131.7	0.000	0.000	6.18	27.4	77.6	0.030	21.3	133.1	529.4
1979	565.2	55.5	14.4	0.000	0.000	0.000	20.7	37.1	0.000	0.000	0.000	0.000
1980	0.000	0.655	0.000	0.000	0.000	0.000	11.1	28.9	1.01	0.000	0.000	0.000
1981	0.000	0.000	1.73	0.000	0.000	0.027	52.9	20.8	26.8	4.49	0.009	0.000
1982	0.000	0.000	0.000	0.000	0.045	0.000	2.80	19.8	11.2	0.000	0.160	14.9
1983	0.913	137.9	181.0	0.683	0.000	0.000	3.97	5.74	63.9	1,525	4.20	4.84
1984	27.6	1.00	0.002	0.028	0.013	0.000	96.6	668.2	107.7			
1991										5.32	0.000	0.000
1992	0.000	0.000	37.1	31.5	1.32	0.000	1.13	74.7	0.073	0.000	0.000	2.78

1993	1,386	52.4	0.168	0.000	0.000	0.000	0.000	7.02	0.000	0.000	0.000	0.000
1994	0.000	0.000	0.000	0.000	0.000	0.000	0.000	4.94	6.83	0.000	5.00	77.0
1995	37.1	11.2	0.000	0.000	0.000	0.000	0.014	0.781	0.153	0.000	0.000	0.000
1996	0.000	0.000	0.000	0.000	0.000	0.000	5.52	1.55	13.8	0.710	0.000	0.000
1997	0.000	0.000	0.000	0.000	0.000	0.000	0.189	6.02	3.00	2.27	0.000	2.47
1998	0.000	18.8	1.88	3.13	0.000	0.000	20.3	3.49	7.48	0.094	0.000	0.000
1999	0.000	0.000	0.000	0.000	0.000	0.000	17.0	17.3	10.7	0.000	0.000	0.000
2000	0.000	0.013	0.903	0.000	0.000	5.27	3.66	16.8	0.000	266.8	129.2	0.000
2001	0.000	0.000	0.000	0.840	0.000	0.020	1.36	0.174	0.050	0.000	0.000	0.000
2002	0.000	0.000	0.000	0.000	0.000	0.000	0.427	2.14	3.81	0.000	0.000	0.000
2003	0.000	0.000	0.000	0.000	0.000	0.000	16.8	5.78	0.119	0.000	0.003	0.000
2004	0.000	0.000	0.000	0.016	0.000	0.000	7.89	8.46	1.67	0.000	0.000	0.000
2005	0.115	1.40	3.22	0.903	0.153	0.000	14.0	100.8	0.000	0.000	0.000	0.000
2006	0.000	0.000	0.000	0.000	0.000	0.000	39.0	24.3	27.5	0.000	0.000	0.000
2007	0.000	0.000	0.000	0.000	0.000	0.000	49.8	38.0	4.47			
Mean of monthly Discharge	42	11	9.5	0.68	0.03	0.43	29	76	18	48	5.0	32

** No Incomplete data have been used for statistical calculation

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USGS 09481740 SANTA CRUZ RIVER AT TUBAC, AZ.

Available data for this site | Time-series: Daily statistics | GO

Santa Cruz County, Arizona
Hydrologic Unit Code 15050301
Latitude 31°36'46", Longitude 111°02'27" NAD27
Gage datum 3,180 feet above sea level NGVD29

Output formats: HTML table of all data | Tab-separated data | Reselect output format

00060, Discharge, cubic feet per second,												
Day of month	Mean of daily mean values for each day for 11 - 12 years of record in, cfs (Calculation Period 1995-10-01 -> 2007-09-30)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	35	25	26	26	13	5.5	5.7	136	60	13	40	28
2	22	25	24	27	13	5.1	16	171	16	28	37	27
3	23	24	23	54	13	5.3	20	113	15	11	27	27
4	25	37	23	21	12	5.3	23	37	13	11	42	26
5	24	28	24	19	12	5.2	21	24	20	11	106	27
6	26	23	23	40	11	5.2	25	45	52	12	60	28
7	28	23	31	50	11	5.0	29	41	37	13	123	28

8	24	23	27	28	11	4.8	48	28	39	12	70	24
9	24	23	23	22	10	4.5	8.7	35	33	26	47	24
10	24	24	23	19	10	4.7	7.7	46	25	15	31	24
11	24	24	23	19	9.7	4.8	7.0	21	32	28	47	24
12	25	27	24	18	9.6	4.8	7.6	40	38	167	60	23
13	27	25	22	18	9.3	4.9	6.6	50	34	52	43	23
14	26	24	21	18	9.0	4.7	11	211	33	11	32	23
15	25	25	23	18	8.5	4.7	15	129	18	9.8	26	23
16	25	26	21	17	8.4	4.7	18	35	24	10	24	25
17	26	25	21	17	9.0	4.6	10	26	34	9.9	23	25
18	26	34	22	17	8.7	10	26	34	13	11	22	24
19	26	35	21	17	8.5	12	42	58	20	11	22	24
20	25	28	23	17	7.9	5.2	44	23	35	125	23	25
21	27	40	20	16	7.8	7.0	31	15	15	73	22	24
22	26	38	20	16	7.6	7.7	117	21	14	245	22	32
23	24	29	20	16	7.6	9.6	91	121	14	637	24	27
24	24	27	19	16	7.2	8.4	42	52	17	156	23	25
25	24	27	19	15	6.6	7.8	136	31	14	86	24	27
26	24	29	20	15	6.8	4.8	57	31	14	65	24	25
27	27	26	19	15	6.6	4.9	77	50	13	60	27	25
28	29	27	18	14	6.4	4.9	112	50	15	144	28	26
29	26	24	18	14	12	8.6	172	75	13	140	30	25
30	26		22	14	6.1	15	70	77	11	112	29	24
31	25		28		5.5		227	19		110		24

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U.S. Department of the Interior | U.S. Geological Survey
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Page Contact Information: NWISWeb Support Team
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USGS 09481770 SANTA CRUZ NR AMADO, AZ

Available data for this site | Time-series: Daily statistics | GO

Pima County, Arizona
Hydrologic Unit Code 15050301
Latitude 31°44'41", Longitude 111°02'11" NAD83
Gage datum 3,040 feet above sea level NAVD88

Output formats

- HTML table of all data
- Tab-separated data
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00060, Discharge, cubic feet per second,												
Day of month	Mean of daily mean values for each day for 4 - 4 years of record in, cfs (Calculation Period 2003-10-01 -> 2007-09-30)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	6.4	6.6	8.5	4.6	3.0	1.1	0.97	151	1.8	1.2	1.4	4.0
2	4.7	6.6	8.9	5.9	3.0	0.99	1.1	492	1.8	1.3	1.6	3.6
3	6.0	6.9	9.3	15	2.6	0.56	0.95	135	2.6	1.1	1.4	2.4
4	9.8	6.9	9.7	5.8	2.7	0.94	5.2	47	3.9	0.85	1.2	2.5
5	11	7.4	9.0	5.2	2.2	1.0	2.4	21	13	0.80	1.2	4.4
6	6.9	7.8	9.3	4.2	2.1	0.93	1.3	35	48	0.90	1.3	6.4
7	6.5	7.9	9.8	3.6	2.3	0.96	0.79	25	53	0.97	1.2	7.9

8	6.9	8.4	8.1	3.2	2.3	0.93	1.5	104	47	0.95	1.2	3.8
9	6.4	8.4	7.6	3.2	2.1	0.82	4.3	159	17	0.85	1.3	3.3
10	6.5	9.2	7.5	3.3	2.0	0.83	5.3	13	17	0.70	1.2	3.1
11	6.9	9.3	7.1	3.4	1.9	0.88	0.71	16	3.6	0.60	1.1	3.1
12	7.3	14	6.8	3.3	1.9	0.93	0.70	31	3.5	0.65	1.2	3.1
13	7.4	13	7.2	3.4	1.9	0.81	0.88	64	64	0.65	1.2	2.7
14	6.8	8.0	7.6	3.5	1.5	0.97	0.99	117	5.9	0.75	1.3	2.8
15	6.6	8.1	7.2	3.1	1.4	0.85	11	95	2.6	0.72	1.2	2.8
16	6.9	8.1	6.7	2.7	1.2	0.80	38	34	34	0.75	1.4	3.1
17	6.6	8.3	6.6	2.9	1.2	0.75	2.3	12	68	0.72	1.6	3.6
18	6.4	8.4	6.6	2.8	1.2	0.90	1.0	1.7	24	0.78	1.8	3.8
19	7.3	8.1	6.3	2.9	1.2	0.90	175	3.9	0.28	0.90	1.9	3.9
20	8.1	9.3	6.7	3.3	0.95	0.80	77	5.9	0.60	1.0	2.0	4.1
21	7.9	8.7	6.1	3.6	1.1	0.95	19	1.3	1.5	1.0	1.8	4.5
22	13	9.3	6.2	3.3	0.80	0.95	16	5.2	0.80	1.2	1.6	4.9
23	7.4	8.4	6.0	3.5	0.60	0.90	22	356	0.90	1.1	1.9	5.4
24	6.3	8.6	5.7	3.8	0.70	1.7	50	24	1.1	1.1	2.0	5.5
25	6.5	8.2	5.1	4.7	0.80	2.2	272	70	1.0	0.95	2.3	5.7
26	6.2	7.8	4.8	4.0	0.90	1.5	48	31	1.0	1.1	2.5	4.8
27	8.6	7.8	4.3	3.6	1.0	1.3	69	5.5	1.1	1.1	2.4	5.3
28	6.7	8.0	4.2	3.4	1.3	1.1	131	3.1	1.2	1.2	2.2	5.7
29	6.4	7.1	4.3	3.4	2.1	1.0	350	9.2	1.4	1.3	2.1	6.4
30	6.2		4.7	3.2	1.8	0.95	117	3.0	2.9	1.4	3.7	7.4
31	6.0		4.7		1.2		243	2.0		1.3		5.6

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USGS 09482000 SANTA CRUZ RIVER AT CONTINENTAL, AZ

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Pima County, Arizona
Hydrologic Unit Code 15050301
Latitude 31°52'17", Longitude 110°58'46" NAD27
Drainage area 1,682.00 square miles
Gage datum 2,819.82 feet above sea level NGVD29

Output formats

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00060, Discharge, cubic feet per second,												
Day of month	Mean of daily mean values for each day for 55 - 56 years of record in, cfs (Calculation Period 1939-10-01 -> 2007-09-30)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	26	2.6	6.3	1.3	0.01	0.00	4.2	104	25	124	1.3	0.21
2	13	2.1	20	1.1	0.01	0.02	2.6	81	38	326	0.23	0.05
3	4.4	2.0	14	5.6	0.01	0.00	2.1	52	20	136	0.07	0.24
4	2.4	44	51	4.5	0.01	0.00	6.1	57	22	71	0.07	0.09
5	2.4	21	38	3.3	0.03	0.00	5.1	140	23	58	2.8	0.29
6	11	16	13	2.6	0.01	0.00	6.1	67	12	54	4.3	22
7	15	9.0	9.6	1.2	0.01	0.00	6.3	103	7.6	44	21	15

8	41	27	6.9	0.22	0.01	0.00	9.0	44	10	100	13	1.1
9	49	27	4.8	0.05	0.01	0.00	3.7	63	22	267	6.3	0.33
10	28	18	4.1	0.04	0.00	0.00	5.1	78	131	95	4.5	7.1
11	90	16	8.4	0.04	0.00	0.00	13	85	34	14	4.3	15
12	88	20	0.71	0.04	0.00	0.00	20	42	41	15	5.4	1.7
13	37	15	7.7	0.04	0.00	0.00	18	129	20	11	6.1	0.23
14	31	11	33	0.03	0.01	0.00	19	199	9.6	1.9	2.5	0.04
15	21	15	26	0.02	0.00	0.00	21	99	3.2	1.4	1.6	21
16	16	12	10	0.02	0.00	0.00	41	84	6.3	0.91	0.87	34
17	15	6.4	5.8	0.01	0.00	0.00	20	62	2.6	0.79	0.42	43
18	229	3.7	2.5	0.01	0.00	0.00	28	62	2.6	0.91	0.17	100
19	298	3.7	1.0	0.02	0.00	0.00	22	120	3.2	4.0	0.05	247
20	21	2.2	0.87	0.01	0.18	0.46	53	104	3.2	2.7	0.05	200
21	11	4.1	4.5	0.01	0.55	0.45	32	129	2.8	19	2.8	34
22	8.7	24	2.1	0.01	0.00	0.47	49	40	9.1	7.0	0.24	52
23	5.0	9.4	1.1	0.01	0.00	2.0	87	101	4.3	65	0.09	103
24	4.3	1.3	4.0	0.01	0.00	0.23	29	81	17	21	9.2	36
25	102	0.52	0.89	0.01	0.00	0.49	43	42	6.4	10	55	11
26	63	0.23	0.30	0.01	0.00	1.3	16	54	18	5.9	8.1	3.7
27	34	0.09	0.28	0.01	0.00	0.00	55	43	2.8	3.8	1.0	3.0
28	11	0.07	2.0	0.01	0.00	3.2	70	48	0.96	7.8	0.05	2.6
29	4.7	0.00	8.4	0.01	0.00	2.5	74	36	3.6	10	0.06	1.3
30	3.8		4.3	0.01	0.00	1.7	64	10	27	7.4	0.14	1.6
31	3.0		2.2		0.00		61	6.8		2.7		36

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Peak Streamflow for Arizona

USGS 09481770 SANTA CRUZ NR AMADO, AZ

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Pima County, Arizona
Hydrologic Unit Code 15050301
Latitude 31°44'41", Longitude 111°02'11" NAD83
Gage datum 3,040 feet above sea level NAVD88

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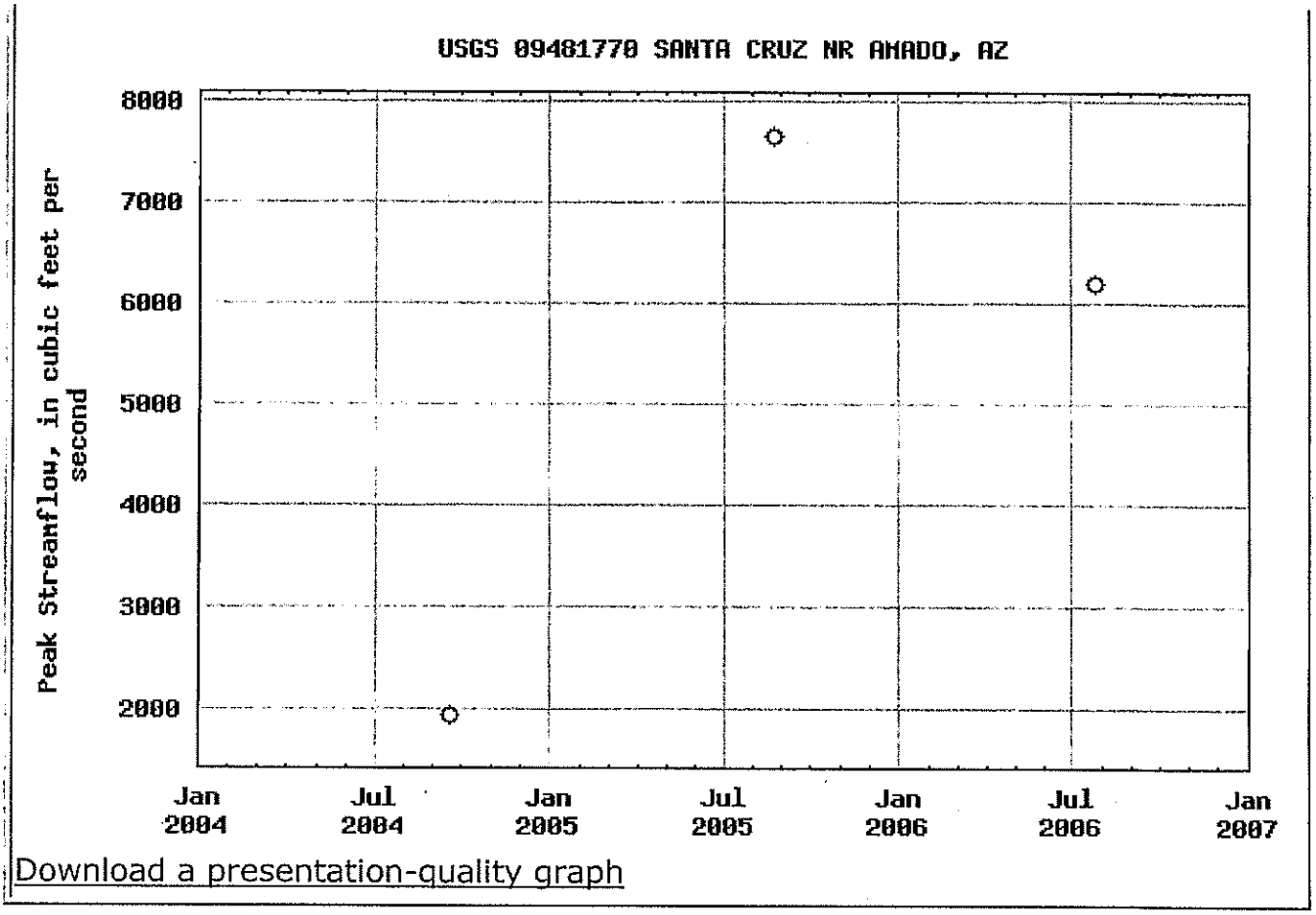

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1.89 1.84 nadww01

Peak Streamflow for Arizona

USGS 09482000 SANTA CRUZ RIVER AT CONTINENTAL, AZ

Pima County, Arizona
Hydrologic Unit Code 15050301
Latitude 31°52'17", Longitude 110°58'46" NAD27
Drainage area 1,682.00 square miles
Gage datum 2,819.82 feet above sea level NGVD29

Output formats

- Table
- Graph
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